

Claims 8, 12, 13, 16, and 18 are amended to read “nickel-base superalloys” rather than “nickel-base alloys,” as disclosed in the application at page 2, lines 27-28; page 3, line 31 to page 4, line 1; page 5, lines 20-21; and page 6, lines 11-18, and have not been amended for reasons relating to patentability. Claim 8 has also been amended to recite an integrated aluminum content of from about 18 to about 28 weight % aluminum, as supported by Fig. 4.

Claims 47 and 73 have been amended to be independent claims, and have been amended only to include all the limitations of now-canceled claims 29 and 56, from which they, respectively, originally depended. Claims 47 and 73 have not been amended for reasons relating to patentability.

Applicant respectfully submits that the above-mentioned claims are amended for reasons not related to patentability, and are fully supported in the original application as filed. Claim 112 is supported in the original application at Fig. 4; page 9, line 24 to page 10, line 2.

II. Rejections of Canceled Claims Are Moot

Applicant has canceled claims 21-25, 27-46, 48-72, 74-88, and 95-111 thus rendering moot rejections thereof. Applicant will only discuss herein claims remaining in the application.

III. 35 U.S.C. § 112 Rejection

Claims 47 and 89-94 have been rejected for allegedly containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. Specifically, it is stated in the Office Action that “[s]upport for the limitations of ‘under deposition conditions effective to . . .’, values of greater than 24 to 28 % aluminum and 8 to less than 18 wt. % platinum, average nickel concentrations, ‘so as to be non-stoichiometric . .

.,' and 'oxidizing the aluminide layer . . .' in claim 29, values of greater than 24 to 28 % aluminum and 8 to less than 18 wt. % platinum in claim 56, and values of greater than 24 to 28 % aluminum and values of 8 to less than 18 wt. % platinum and the claimed average nickel concentrations in claim 89 is totally lacking in the application as originally filed." Applicant respectfully submits that support for each of these claim limitations was present in the application as originally filed, as is detailed below.

Claim 47 is a method claim for forming a thermal barrier on a substrate, and the first step thereof reads, "chemical vapor depositing a diffusion aluminide layer on the substrate which includes a nickel base superalloy substrate under deposition conditions effective to provide an outer aluminide layer region comprising a solid solution intermediate phase and an inner diffusion zone region proximate the substrate . . ." An aluminide is well known in the art to be an intermetallic material with ordered crystalline structure including aluminum and another metal, or combination of metals. Thus, the term "diffusion aluminide layer" conveys to one skilled in the art that the referred-to layer comprises the diffusion of at least two metals, which in the specification necessarily include platinum and aluminum, as detailed in the application as filed, *e.g.*, at page 6, lines 26-31, and page 7, lines 1-26. *See also, e.g.*, Application, page 6, line 11 ("The optimized platinum-aluminide coating of the invention . . .")

Further, the conditions for depositing the platinum and aluminum on the substrate are also fully described in the application as filed at page 6, lines 26-31 and page 7, lines 1-26, those conditions being (1) deposition of platinum on the surface of the substrate; (2) diffusion of platinum into the surface of the substrate by heating the substrate and the deposited layer of platinum for 2 hours at 1800-2000°F, where steps 1 and 2 may be conducted simultaneously or

serially; (3) providing a source of aluminum; and (4) contacting the source of aluminum to the previously deposited platinum, thus depositing an aluminum layer over the platinum substrate. Steps 3 and 4 are typically conducted simultaneously at elevated temperature so that aluminum is diffused into the surface of the platinum-enriched region and the substrate. The conditions for the aluminum deposition and diffusion are detailed as 4-16 hours at a temperature of 1925-2050 °F. *See* Application, page 7, lines 24-26. *See also* Application, page 7, lines 27-28.

Thus, the deposition conditions for both the platinum layer and the aluminum layer that make up the disclosed platinum aluminide specified in claim 47 are fully detailed in the application as filed.

It is stated in the Office Action that claim 47 sets forth limitations of “values of greater than 24 to 28 % aluminum and 8 to less than 18 wt. % platinum” and “average nickel concentrations” which allegedly are not supported in the original application as filed. Applicant respectfully submits that Fig. 4, along with the accompanying discussion of Fig. 4, discloses that amounts of aluminum greater than 24 to 28 % and amounts of platinum of 8 to less than 18 weight % in the diffusion aluminide layer may be used. *See, e.g.*, Fig. 4 (disclosing aluminum weight ranges from about 18 to about 30 weight % and platinum weight ranges from 0 to about 50 weight %); *see also* Application, page 9, line 24, through page 10, line 2 (disclosing that the region of significantly improved performance for platinum-aluminum regions has an integrated aluminum content of from about 18 to about 24 percent by weight and an integrated platinum content of from about 18 to about 45 percent by weight, although “[o]utside of these limits, protection afforded by the surface region decreases.”)

Further, once these weight ranges of aluminum and platinum are supported, the disclosure of the balance of the nickel concentrations necessarily follows. The original application indicated that the substrate components make up the remainder of the surface region, primarily nickel, cobalt, and chromium. *See* Application, page 3, lines 8-9, 25-26; page 8, lines 1-4, line 30- page 9, line 1; claims. As is well known by persons skilled in the art of metallurgy, and in particular, aluminide compositions, nickel preferentially migrates from the substrate into the aluminide layer in higher proportions than found in the substrate composition. Thus, nickel is represented in the aluminide layer at higher percentages than it is found in the alloy substrate.

When Fig. 4 is analyzed in light of the preferential nickel migration into the aluminide layer, an entire line of points exists in Fig. 4 where Ni can exist up to 50 weight % in the platinum aluminide layer, drawn along a line where weight % Al plus weight % Pt substantially equals 50 weight %. For example, at the point where the platinum aluminide comprises 25 weight % Al and 25 weight % Pt, Ni can be present up to 50 weight %. Likewise, Ni can be present in amounts up to 50 weight % where Al is 18 weight % and Pt is 32 weight %. Both of these compositions fall within the claimed aluminum and platinum weight ranges. Even taking into account potentially small amounts of other elements in the aluminide layer other than Ni, a line of up to 50 weight % Ni is defined in Fig. 4 as calculated above, taking into account the amount of other elements in the overall composition. For example, if cobalt plus chromium were present for a total of 2 weight % of the aluminide layer, 50 weight % Ni would be found on the line where weight % Al plus weight % Pt equals 48 %, which could be satisfied, for example, where weight % Al equals 25 and weight % Pt equals 23. These points fall within Fig. 4, as well as the compositions claimed in claim 47.

Similar calculations can be made for a line representing 60 weight % Ni on Fig. 4. An exemplary point is found where weight % Al equals 18 and weight % Pt equals 22. Thus, the claimed weight ranges of 50 to 60 weight % Ni are fully supported in Fig. 4 of the application as filed.

It is also stated in the Office Action that the limitation "so as to be non-stoichiometric . . ." is not supported in claim 47 of the original application as filed. However, the application as filed specifies that the complex formed in the platinum-aluminum region is a single phase, substantially the β NiAl phase of the nickel-aluminum compound, which is necessarily formed under the specified deposition conditions according to sources well known in the art, including the Ni-Al phase diagram present as Fig. 2 in U.S. Patent No. 5,716,720 issued to Murphy ("Murphy"). *See* Application, page 8, lines 18-21; page 9, lines 3-4. In this phase, Ni and Al are present 50%/50% on an atomic basis. A structure of this phase with 50 atomic % Ni necessarily contains 31.2 weight % Al. The claimed Al levels as set forth in claim 47 are 18 to 28 weight %, or less than 31.2 weight % Al, which further necessarily means that Al is hypostoichiometric, and thus nonstoichiometric, in the aluminide layer for a substantially pure NiAl crystal structure.

The Al nonstoichiometry is also necessarily present in a platinum aluminide that includes both NiAl and PtAl. When Pt is added to a NiAl compound, the Pt atoms are known to replace Ni one-for-one in the crystal structure. For the maximum claimed Al level of 28 weight % in the platinum aluminide region, with the Ni content maintained between 50 to 60 weight %, the Pt must necessarily range from 12 to no more than 22 weight %. On an atomic basis, resulting Al

levels necessarily range from 48.9 to 51.8 atomic %, or levels that are non-stoichiometric (either greater than or less than 50 atomic %).

Thus, Applicant respectfully submits that the limitation that the intermediate phase of Al, Pt, and Ni is nonstoichiometric relative to intermetallic compounds of aluminum and nickel, or aluminum and platinum, is supported in the application as filed.

Finally, it is stated in the Office Action that the limitation of "oxidizing the aluminide layer . . ." is totally lacking support in claim 47 in the application as filed. Oxidation of the surface of the diffusion aluminide layer to a protective aluminum oxide scale is disclosed at page 2, lines 14-15 of the application. Also, an annealing process is described at page 9, lines 6-12 of the application, which process is noted in the Office Action at page 4 as meeting the oxidizing step of Murphy. Thus, Applicant respectfully submits that the claimed limitation of oxidizing the aluminide layer is disclosed in the application as filed. *Handwritten: Oxidizing layer*

Claims 73 and 89 were similarly rejected in the Office Action on the grounds that the limitation of claimed "values of greater than 24 to 28 % aluminum and 8 to less than 18 wt. % platinum . . . [are] totally lacking in the application as originally filed." Claims 73 and 89 are both method claims, and include the limitations of about 18% to about 28% by weight integrated aluminum content, about 8 to about 45 percent by weight integrated platinum content. As discussed with regard to claim 47, Applicant respectfully submits that Fig. 4, along with the discussion of Fig. 4, discloses that the weight range of 24 to 28 % aluminum and lower weights of platinum (*i.e.*, less than about 18 percent by weight) in the diffusion layer may be used. *See, e.g.*, Fig. 4 (disclosing aluminum weight ranges from about 18 to about 30 % and platinum weight ranges from 0 to about 45 weight %); *see also* Application, page 9, line 24, through page

10, line 2 (discussing that the region of significantly improved performance for platinum-aluminum regions has an integrated aluminum content of from about 18 to about 24 percent by weight and an integrated platinum content of from about 18 to about 45 percent by weight, although “[o]utside of these limits, protection afforded by the surface region decreases.”)

Claim 89 was also similarly rejected in the Office Action on the grounds that the limitation of “the claimed average nickel concentrations . . . [are] totally lacking in the application as originally filed.” Claim 89 includes the limitation that the platinum-aluminide surface region comprises from about 31 percent by weight to about 74 percent by weight integrated nickel content. As for claim 47, once the claimed weight ranges of aluminum and platinum are supported, the disclosure of the balance of the nickel concentrations necessarily follows. As discussed, the application, as filed, states that the substrate components make up the remainder of the surface region. In particular the nickel, cobalt, and chromium migrate, and those skilled in the art of metallurgy know that of these elements nickel preferentially migrates into the platinum aluminide layer (or surface region). *See also* Application, page 3, lines 8-9, 25-26; page 8, lines 1-4, lines 30-31; claims. The nickel concentration in the platinum aluminide layer can thus range from about 27 weight % to about 74 weight %, based on Al plus Pt weight concentrations totaling about 26 weight % to about 73 weight %, assuming substantially only nickel migrates from the substrate into the aluminide layer.

This range of weight % Ni is further supported by the specific examples of substrates disclosed starting at page 5, line 23 through page 6, line 10, which set forth a range of nickel content of exemplary substrates of about 57 to about 63 % by weight nickel. In claim 89, given the limitations on weight concentrations of aluminum and platinum and the disclosure that the

remainder of the diffusion layer is made up of the bulk substrate composition, migrating elements from the bulk substrate composition must necessarily make up from about 27 % by weight to about 74 % by weight of the diffusion layer (as determined by adding together the lower aluminum and platinum weight concentrations and also the higher aluminum and platinum weight concentrations). If the bulk substrate composition has 57 weight % nickel, and if the elements of the substrate were to migrate in their exact proportions, the diffusion layer would have from about 15 to about 42 weight % nickel (based on a total aluminum plus platinum weight concentration of 26 to 73 % in the diffusion layer). As the Ni preferentially migrates over the other components of the substrate, the weight % of Ni in the aluminide layer will rise to the point where only Ni migrates, which is 27 to 74 weight %. The fully disclosed nickel concentration in the platinum aluminide layer in the application is thus about 15 up to about 74 % by weight, and completely supports the limitation in claim 89 of about 31 to about 74 percent by weight Ni.

Thus, Applicant respectfully submits that the application, as filed, supports the disclosure of aluminum content of from about 24 to 28 weight %, and as low as zero and certainly about 8 to 18 weight % platinum and about 31 to about 74 weight % nickel in the platinum aluminide region.

For all the reasons set forth above, Applicant respectfully requests the withdrawal of the claim rejections under 35 U.S.C. § 112, first paragraph.

IV. Double Patenting Rejection

Claims 8-13 and 16-18 have been provisionally rejected under 35 U.S.C. § 101 as claiming the same invention as that of claims 8-13 and 16-18 of copending Application No.

09/244,578. Applicant has amended independent claims 8 and 16, and respectfully requests the withdrawal of this rejection.

Claims 47, 73, and 89-94 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 47, 71, and 87-92 of copending application Ser. No. 09/244,578.

Applicant will file a terminal disclaimer pursuant to 37 C.F.R. § 1.321(c) for the later of these two applications to issue if this rejection is appropriate at that time.

V. Claim Rejections under 35 U.S.C. § 102(e)

Claims 8-13 have been rejected under 35 U.S.C. § 102(e) as allegedly being anticipated by Murphy, U.S. Patent No. 5,716,720 (“Murphy”). The Office Action rejection apparently is based on the premise that col. 3, lines 55-58, col. 4, lines 5-19, col. 5, N5 substrate in the examples, and the claims of Murphy necessarily describe the invention in a patent granted on an application for patent by another (Murphy) filed in the United States before the invention thereof by Applicant.

Applicant respectfully submits that the cited reference does not anticipate claims 8-13. According to the MPEP, “[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference,” *citing Verdegaa Bros. v. Union Oil Co. of California*, 814 F.2d 826, 831 (Fed. Cir. 1987).

Specifically, Applicant submits that Murphy did not anticipate each and every element of the cited claims prior to their amendment herein. The amended claims 8-13, 47 and 71 continue to be novel in view of Murphy.

Claim 8 is an independent method claim for preparing an article having a platinum-aluminide surface region, and claims 9-13 are dependent claims from claim 8. Murphy is cited in the Office Action, specifically Murphy col. 3, lines 55-58, col. 4, lines 5-19, N5 substrate in the examples, and the claims as disclosing the method claimed in claims 8-13. The method claimed in claim 8 includes: (1) providing a substrate having a nickel-base superalloy substrate bulk composition and a substrate surface; (2) depositing a layer of platinum onto the substrate surface; (3) diffusing platinum from the layer of platinum into the substrate surface; (4) providing a source of aluminum; and (5) diffusing aluminum from the source of aluminum into the substrate surface to produce a surface region at the substrate surface. The surface region is recited as having an integrated aluminum content of from about 18 to about 28 percent by weight, and an integrated platinum content of from about 18 to about 45 percent by weight, balance components of the substrate bulk composition.

Murphy discloses: (1) a platinum modified intermediate phase of aluminum and nickel with an overall thickness of the bondcoat in the range of about 1.5 to about 3.0 mils; with (2) the intermediate phase having an average aluminum concentration through the layer thickness in the range of about 18 to about 26% by weight, an average platinum concentration in the range of about 8 to about 35% by weight, and an average nickel concentration in the range of about 50 to 60% by weight, that is non-stoichiometric relative to intermetallic compounds of aluminum and nickel, aluminum and cobalt, and aluminum and platinum in cited sections col. 3, lines 55-58 and col. 4, lines 5-19. However, these sections do not disclose Applicant's claimed method of claim 8, and claims 9-13 which depend from claim 8, for preparing an article having a platinum-aluminide surface region.

The N5 substrate in the examples, beginning at col. 6, line 4 and continuing to col. 7, line 33, disclose both average concentrations of Al, Pt, and Ni through the thickness of the bondcoat for several alloy N5 substrate specimens, and also disclose briefly a process to form the bondcoat at col. 6, lines 7-41.

Nowhere in these cited portions of Murphy are all of the process limitations of claim 8 disclosed. For example, no mention is made in Murphy of depositing a layer of platinum upon a substrate surface and diffusing platinum from the layer of platinum into the substrate surface in a step separate from aluminum deposition and diffusion. Even if those portions of Murphy that further describe the formation of the bondcoat are considered, these process limitations are not disclosed. *See* Murphy, col. 2, lines 45-51 (“The platinum modified diffusion aluminide layer preferably is formed by depositing a layer of platinum or alloy thereof on the substrate and chemical vapor depositing aluminum on the platinum covered substrate under high temperature and low aluminum activity conditions to form the inner diffusion zone and the outer intermediate phase region.”). *Also see* col. 4, lines 25-28. In fact, the process disclosed in Murphy expressly *does not* diffuse platinum after the platinum is deposited on the substrate surface in a step separate from aluminum deposition and diffusion. *See* Murphy, col. 4, lines 45-48 (“For example, generally, the substrate is electroplated with a 9-11 milligram/centimeter squared platinum layer (e.g. 2 mil thick Pt layer) and then subjected, *without a Pt prediffusion treatment*, to CVD aluminizing . . .”) (emphasis added). Further, the integrated aluminum content in claim 8, as amended, is not disclosed by Murphy.

Since Murphy does not disclose each and every element as set forth in claim 8, either expressly or inherently, Applicant respectfully submits that Murphy cannot anticipate claims 8-13 and requests that this rejection be withdrawn with respect to claims 8-13.

VI. 35 U.S.C. § 103 Rejections

Claims 8, 10-13, 16-18, 73, and 89-94 have been rejected as allegedly being obvious pursuant to 35 U.S.C. § 103(a). Applicant respectfully submits that the Office Action fails to carry the burden of factually supporting several of the criteria of a *prima facie* case of obviousness, such as (1) showing that the reference teaches or suggests all the claim limitations in each instance and/or (2) a suggestion or motivation to modify the reference or to combine reference teachings. Applicant further submits that none of these claims was obvious in view of the applied references prior to the amendment of the claims herein. The claims continue to be patentable in view of these references.

A. Claims 16-18 and 89-94 over Murphy

Claims 16-18 and 89-94 are rejected under § 103(a) as being allegedly unpatentable over Murphy because, although “Murphy does not explicitly disclose the aluminum source activity as recited in claims 16 and 87 [*sic* 89?] . . . Murphy discloses deposition at low aluminum activity conditions at col. 4, lines 25-30 which one of ordinary [skill in the art] would consider to include values in the claimed range . . . Therefore, use of the claimed aluminum values would have been obvious absent evidence showing criticality of using these values over other ‘low’ activities.” Office Action, page 4. Independent claims 16 and 89 recite, *inter alia*, providing a source of aluminum having an activity of about 40 to about 50 atomic percent as measured in a pure nickel

foil, and depositing aluminum onto a substrate by using an aluminum source having the same aluminum activity.

Applicant respectfully submits that Murphy does not render independent claims 16 and 89 obvious because Murphy does not teach or suggest all the claim limitations, specifically the claim limitations of a heating step following the platinum deposition on the substrate surface separate from aluminum deposition onto the platinum layer. Claim 16 is a method for preparing an article having a platinum-aluminide surface region comprising: (1) providing a substrate having a nickel-base superalloy substrate bulk composition and a substrate surface; (2) depositing a layer of platinum about 0.0003 inches thick upon the substrate surface; (3) heating the substrate and layer of platinum to a temperature of about 1800-2000°F for a time of about 2 hours; (4) providing a source of aluminum in contact with the substrate surface . . . ; and simultaneously (5) heating the substrate surface and source of aluminum to a temperature of about 1925-2050°F for a time of from about 4 to about 16 hours. Similarly, claim 89 recites a method of forming a platinum-aluminide surface region proximate to the surface of a nickel-base superalloy substrate comprising *inter alia*: (1) forming a platinum layer at the substrate surface; (2) heating the substrate to a temperature of from about 1800 to about 2000°F for a time of about 2 hours; and (3) depositing aluminum onto the nickel-base superalloy substrate and diffusing aluminum into the substrate surface. Thus, both claims include an element whereby the substrate is heated *after* the platinum has been deposited, separately from the aluminum being deposited and diffused.

The process disclosed in Murphy, however, expressly teaches away from the step of diffusing platinum *after* the platinum is deposited on the substrate surface and separately from

the aluminum deposition step. *See* Murphy, col. 4, lines 45-48 (“For example, generally, the substrate is electroplated with a 9-11 milligram/centimeter squared platinum layer (e.g. 2 mil thick Pt layer) and then subjected, *without a Pt prediffusion treatment*, to CVD aluminizing . . .”) (emphasis added). Thus, since Murphy does not teach or suggest each and all the claim limitations of claims 16 and 87, a *prima facie* case of obviousness has not been made in the Office Action. Further, this argument extends to claims 17-18, dependent from claim 16, and claims 90-94, dependent from claim 89. Applicant thus respectfully requests that this rejection be withdrawn.

B. Claim 16 over Shankar

Claim 16 has been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Shankar, U.S. Patent No. 4,501,776 (“Shankar”) because, “Shankar discloses the claimed process at col. 1, line 50 to col. 2, line 41, with the exception that the ranges for the process conditions taught by Shankar overlap the claimed ranges.”

Applicant respectfully submits that Shankar does not disclose or suggest each and every limitation of claim 16, and therefore claim 16 is patentable over Shankar. Specifically, claim 16, as amended, contains the limitations of “providing a substrate having a nickel-base superalloy substrate bulk composition” and “providing a source of aluminum in contact with the substrate surface, the source having an activity of about 40 to about 50 atomic percent as measured in a pure nickel foil,” which limitations are not disclosed or suggested in Shankar. In Applicant’s specification, nickel-base superalloys are repeatedly referred to as a preferred substrate. *See, e.g.,* Application, page 2, lines 27-28; page 3, lines 4-5, 17; page 4, line 1; page 5, line 20 to page 6, line 25; page 9, line 21; claims, Abstract. Shankar, however, discloses a method of forming a

protective diffusion layer on nickel, cobalt and iron base alloys, as contrasted to the nickel superalloys of the invention which do not contain iron as set forth from page 5, line 20 to page 6, line 10, and does not disclose or suggest that the disclosed method and conditions can be used to form a similar protective diffusion layer on substrates other than the disclosed and claimed nickel, cobalt, and iron base alloy, which is not a nickel-base superalloy as is well known in the art.

Also, Shankar does not disclose or suggest the activity limitation of the aluminum source as set forth in claim 16. In fact, Shankar does not disclose any activity of the aluminum source.

Since Shankar does not disclose or suggest each and every claim limitation of claim 16, Applicant respectfully submits that the initial burden of factually supporting several of the criteria of a *prima facie* case of obviousness was not met in the Office Action. Such criteria include a showing that the reference teaches or suggests all the claim limitations or a showing of a suggestion in the art that the reference should be modified to include all of Applicant's claimed limitations. For at least these reasons, this rejection must be withdrawn.

C. Claim 17 over Shankar in view of Duderstadt

Claim 17 has been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Shankar in view of Duderstadt *et. al.*, U.S. Patent No. 5,238,752 ("Duderstadt") because, "Shankar lacks teaching of EB vapor depositing a columnar structure yttria stabilized zirconia TBC . . . However, because Duderstadt discloses that deposition of such TBC on platinum aluminide coating by EBPVD provides the advantages described at col. 5, lines 1-10 (abstract, col. 7), it would have been obvious to have deposited the TBC to achieve these advantages." Office Action, page 6.

This rejection is a § 103 combination rejection. It is well established that a proper § 103 combination rejection requires more than just finding in the references the elements recited in the claim. To reach a proper teaching of a process through a combination of references, there must be stated in the reference(s) (or shown in the knowledge generally available in the art) an objective motivation to combine the teachings of references, not a hindsight realization in light of the disclosure of the specification being examined. *See* MPEP 2143 and 2143.01; *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 n.1 (Fed. Cir. 1988) (“The PTO has the burden under section 103 to establish a prima facie case of obviousness . . . It can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references . . . One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.”) *See also In re Laskowski*, 10 U.S.P.Q.2d 1397, 1398 (Fed. Cir. 1989); *W.L. Gore & Assoc. v. Garlock*, 220 U.S.P.Q. 303, 311-13 (Fed. Cir. 1983); *Ex Parte Levengood*, 28 U.S.P.Q.2d 1300 (Board of Appeals and Interferences, 1993); *Ex Parte Chicago Rawhide Mfg. Co.*, 223 U.S.P.Q. 351 (Board of Appeals and Interferences, 1984).

“The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.” *In re Mills*, 916 F.2d 680 (Fed. Cir. 1990); MPEP 2143.01.

In the rejection, no objective basis was established for combining the teachings of the references; instead, a selection of helpful portions from each reference was made while ignoring the unhelpful portions. Shankar has no teaching of the use of any substrate other than a nickel, cobalt and iron base alloy for the disclosed protective diffusion layer. Further, although

Duderstadt discloses a thermal barrier coating system on a nickel-based superalloy, there is no suggestion in either Duderstadt or Shankar to modify Shankar not only with respect to the ceramic layer but also the substrate. The case law and the MPEP make it clear that it is not proper to selectively choose isolated teachings from one reference and combine them with those of a second reference, simply because they may be useful elements for forming a rejection and without any objective basis for doing so. In the Office Action, no factual basis is stated for combining the teachings of these two references.

Also, neither Shankar nor Duderstadt disclose or suggest the activity limitation of the aluminum source as set forth in claim 16, from which claim 17 depends. In fact, neither Shankar nor Duderstadt disclose any limitation on the activity of the aluminum source, and therefore each and every claim limitation of claim 17 would not have been suggested to a person of ordinary skill by even the improper combination of the cited references.

In the absence of a suggestion to modify Shankar with the thermal barrier layer of Duderstadt, a *prima facie* case of obviousness has not been factually supported in the Office Action. In addition, each and every claim limitation of claim 17 is not disclosed or suggested in the cited references. Withdrawal of this obviousness rejection is requested, particularly in light of the different substrate used by Shankar as compared to Applicant's invention.

D. Claim 18 over Shankar in view of Wukusick

Claim 18 has been rejected as allegedly unpatentable over Shankar in view of Wukusick *et. al.*, U.S. Patent No. 5,100,484 ("Wukusick"). It was stated in the Office Action that Shankar teaches nickel-based alloy turbine substrates but does not disclose the contents of aluminum, rhenium, etc. However, claim 18 was rejected over the combination of Shankar and Wukusick

“because Wukusick discloses that substrates with the claimed components are known alloys for use as turbine parts, it would have been obvious to use such conventional substrates with the expectation of their being effective for turbine substrates.” Office Action, page 5.

Again Applicant respectfully submits that there is no suggestion within the prior art to modify the references or to combine Shankar with Wukusick. Specifically, there is no suggestion to combine the teachings of Shankar and Wukusick to substitute the nickel, cobalt, and iron substrate of Shankar with the nickel-base superalloys of Wukusick. The allegation that a certain alloy may be suitable for use as a turbine substrate does not force the conclusion that a specific diffusion layer would be suitable for that substrate, and, absent a prior art-based suggestion to do so, is an improper basis for a § 103 combination rejection.

Applicant reiterates that a § 103 obviousness combination rejection requires more than just a finding in the references the elements recited in the claim. To reach a proper teaching of Applicant's claimed process through a combination of references, there must be identified in the prior art an objective motivation to combine the teachings of references, not a hindsight realization in light of the disclosure of the specification being examined. Wukusick is directed to a heat treatment of nickel-base superalloys. There is no teaching in Wukusick for forming a protective diffusion layer on the superalloys, much less that the diffusion layers disclosed in Shankar would be acceptable on these very different base alloys.

Also, neither Shankar nor Wukusick disclose the activity limitation of the aluminum source as set forth in claim 16, from which claim 18 depends. In fact, neither Shankar nor Wukusick disclose any limitation on the activity of the aluminum source, and therefore each and

every claim limitation of claim 18 would not have been present in the improperly-formed combination of the cited references.

In the absence of a suggestion to modify Shankar with the nickel base superalloy of Wukusick, a *prima facie* case of obviousness has not been factually supported in the Office Action. In addition, each and every claim limitation of claim 18 would not have been included in the improper combination of the references. For at least these reasons, withdrawal of this obviousness rejection is solicited.

E. Claim 73 over Conner in view of Duderstadt

Claim 73 has been rejected as allegedly unpatentable under 35 U.S.C. § 103(a) over Conner *et. al.* (*Evaluation of Simple Aluminide and Platinum Modified Aluminide Coatings on High Pressure Turbine Blades after Factory Engine Testing*) in view of Duderstadt because, “Conner discloses the claimed process . . . with the exception that Conner does not teach depositing a TBC . . . Application of a TBC would have been obvious in view of Duderstadt.” Office Action, page 6. Applicant submits that this § 103 obviousness combination rejection is improper because, again, there is no suggestion in the references to combine their teachings.

Claim 73 incorporates all the limitations of now-canceled claim 56, and thus relates to a method for forming a thermal barrier coating on a substrate, comprising, *inter alia*, the steps of: (1) chemical vapor depositing a diffusion aluminide layer on the substrate which includes a nickel base superalloy substrate; and (2) depositing a ceramic thermal barrier layer on the aluminide layer. The diffusion aluminide layer includes an average aluminum concentration in the range of about 18 to about 28 % by weight and an average platinum concentration in the range of about 8 to about 45 % by weight. Most of Duderstadt’s disclosure is focused on an

entirely different process for forming a diffusion platinum aluminide layer from that claimed in claim 73. Specifically, Duderstadt describes deposition of platinum on a nickel-base superalloy surface and then pack cementizing aluminum on the surface to form the diffusion platinum aluminide layer. *See* Duderstadt, col. 3, lines 13-20; col. 5, line 44 to col. 6, line 2; col. 8, lines 31-33; col. 9, lines 48-49. Duderstadt discloses chemical vapor deposition of aluminum as well but only in connection with a nickel aluminide coating, which is distinct from the chemical vapor deposition of aluminum to form a platinum aluminide as set forth in claim 73. *See* Duderstadt, column 9, lines 45-49; col. 10, lines 3-4 and lines 45-55.

Conner evaluates platinum aluminide layers formed both by the pack cementation and chemical vapor deposition processes. However, Conner does not suggest or disclose the use of the thermal barrier coatings of Duderstadt on the diffusion aluminide layers, and therefore there is no suggestion within these references to modify Conner with the TBC of Duderstadt. Further, since Duderstadt is primarily concerned with TBCs formed on diffusion platinum aluminide layers that are formed by a pack cementation process, there is no suggestion in either Duderstadt or Conner that TBCs would be operable on diffusion platinum aluminide layers formed by other processes than pack cementation, as for example chemical vapor deposition.

In fact, the disclosure in Conner bolsters the argument that such TBCs operable on diffusion platinum aluminide layers formed by pack cementation may *not* be operable on diffusion platinum aluminide layers formed by chemical vapor deposition. Conner discloses the preparation of two platinum aluminide coated turbine blades, the first one using a pack cementation process and the second one a chemical vapor deposition process. *See* Conner, page 2. In both samples, platinum was deposited to a thickness of 0.2 to 0.4 mils by electroplating and

diffused into the substrate prior to aluminizing. *Id.* Conner proceeds to note that the resultant microstructure using pack cementation to deposit the aluminum was a two phase outer layer, a middle zone of β NiAl, and a diffusion zone, while the CVD PtAl coating consisted of an additive layer comprised of NiPtAl and a diffusion zone. *Id.* Conner goes on to note that the two processes created different structures for the coatings: the addition layer to diffusion zone ratios for the pack PtAl coating was 6:1, indicating an inward coating structure, while the ratio for the CVD PtAl coating was 1.6:1, indicating an outward coating structure. *Id.* These differences are further borne out by a comparison of the Pt and Al gradients across the diffusion layers as shown in Fig. 3. *Id.* at 3. A very different gradient of both Pt and Al is found when the pack cementation process is compared to the CVD process.

Thus, there is no suggestion in Conner that a TBC could be used on a diffusion platinum aluminide layer formed by CVD of the aluminum. Furthermore, the disclosure in Conner actually suggests that, with the very different structures formed by the two different processes of pack cementation and CVD, one would not expect similar results for depositing a TBC on the two very different diffusion platinum aluminide layer outer surfaces.

There is no suggestion in the cited references to combine their teachings, and in fact Conner suggests that different results would be expected due to the very different structures of the diffusion aluminide layers formed by the different aluminum deposition processes of pack cementation and chemical vapor deposition. For at least these reasons, the § 103 obviousness combination rejection is improper, and must be withdrawn.

F. Claims 8, 10, 11, and 89-92 over Conner in view of Shankar

Claims 8, 10, 11, and 89-92 have been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Conner in view of Shankar. Claim 8 is directed to a method for preparing an article having a platinum-aluminide surface region comprising: (1) providing a substrate having a nickel-base superalloy substrate bulk composition and a substrate surface; (2) depositing a layer of platinum upon the substrate surface; (3) diffusing platinum from the layer of platinum into the substrate surface; (4) providing a source of aluminum; and (5) diffusing aluminum from the source of aluminum into the substrate surface for a time sufficient to produce a surface region at the substrate surface. The surface region further comprises an integrated aluminum content of from about 18 to about 28 percent by weight, an integrated platinum content of from about 18 to about 45 percent by weight, and the balance components of the substrate bulk composition. Claims 10 and 11 depend from claim 8, and further claim annealing the substrate and the surface region, and a further limitation on the integrated aluminum, platinum, and substrate bulk composition, respectively.

Claim 89 is directed to a method of forming a platinum-aluminide surface region proximate to the surface of a nickel-base superalloy substrate comprising: (1) forming a platinum layer at the substrate surface; (2) heating the substrate to a temperature of from about 1800 to about 2000°F for a time of about 2 hours; and (3) depositing aluminum onto the nickel-base superalloy substrate and diffusing aluminum into the substrate surface. Claims 90-92 are dependent from claim 89, and add further limitations on the method of claim 89.

The basis for the rejection of all of these claims is that, “Conner discloses the claimed process at page 2 . . . with the exception that Conner is silent as to particular aluminiding and

platinum diffusion conditions. It would have been obvious to use the claimed diffusion and aluminizing conditions in view of Shankar for the reasons set forth above.” Office Action, page 6.

Applicant submits that this obviousness combination rejection is improper because, again, there is no suggestion within the four corners of the cited prior art to combine the teachings of the references. Independent claims 8 and 89 recite the use of a nickel-base superalloy substrate. Although Conner discloses the coating of a nickel-base superalloy with a platinum aluminide diffusion layer, Conner does not suggest that this coating could be used on other substrates, such as those of Shankar. Shankar discloses conditions for forming a platinum aluminum diffusion layer on a nickel, cobalt, and iron substrate, but does not suggest that these conditions could be used to form a platinum aluminum diffusion layer on other substrates.

Also, neither Conner nor Shankar disclose or suggest the activity limitation of the aluminum source as set forth in claim 89. In fact, neither Conner nor Shankar disclose or suggest any limitation on the activity of the aluminum source, and therefore each and every claim limitation of claim 89 is not present in the cited references. Further, neither Conner nor Shankar discloses or suggests the annealing limitation of claims 10 and 92. Since each and every claim limitation of these claims has not even been suggested, much less disclosed, in the cited references, the § 103 rejection is improper and must be withdrawn with respect to claims 10 and 92.

Again, referring to but without repeating the previously cited case law and MPEP support regarding obviousness combination rejections, no basis is given in the rejection for the use of the conditions cited in Shankar on the substrate cited in Conner. No suggestion is given in Shankar

that the disclosed conditions to form the diffusion layer could be used on other substrates.

Without a suggestion to combine the cited references of Shankar and Conner, this rejection must be withdrawn with respect to all of these claims.

G. Claims 93 and 94 over Conner in view of Shankar and further in view of Duderstadt

Claims 93 and 94 have been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Conner in view of Shankar and further in view of Duderstadt because, “[a]pplication of a TBC would have been obvious in view of Duderstadt for the reasons set forth above.” Office Action, page 7.

For the same reasons given above for claim 89, Applicant submits that this rejection is an improper § 103 combination rejection because there is no suggestion in the prior art to combine the references. Claims 93 and 94 depend from claim 89. As discussed, independent claim 89 recites conditions for a method of forming a platinum aluminide surface region proximate the surface of a nickel-base superalloy substrate. Although Conner and Duderstadt disclose the coating of a nickel-base superalloy with a platinum aluminide diffusion layer, neither Conner nor Duderstadt suggest that the conditions disclosed in Shankar should or could be used on these types of other substrates. Although Shankar discloses a two step process of depositing platinum and diffusing platinum prior to diffusion of aluminum onto the substrate, Shankar discloses a method of forming a protective diffusion layer on nickel, cobalt and iron base alloys, as contrasted to the nickel superalloys of the invention which do not contain iron as set forth from page 5, line 20 to page 6, line 10, and does not disclose or suggest that the disclosed method and conditions can be used to form a similar protective diffusion layer on other substrates. Conner and Duderstadt disclose the coating of a nickel-base superalloy with a

platinum aluminide diffusion layer. However, they do not recite the conditions set forth in claim 89 for forming a platinum aluminide coating, or suggest that Shankar's conditions for forming a platinum aluminide coating would be acceptable on nickel base superalloy substrates.

Also, neither Conner, Shankar, nor Duderstadt disclose the activity limitation of the aluminum source as set forth in claim 89, from which claims 93 and 94 depend. In fact, neither Conner, Shankar, nor Duderstadt disclose any limitation on the activity of the aluminum source, and therefore each and every claim limitation of claims 93 and 94 is not present or suggested in the cited references and would not have been suggested by the combination of the references.

Again, referring to but without repeating the previously cited case law and MPEP support, no basis is given in the rejection for the use of the conditions disclosed in Shankar on the substrate taught in Conner or Duderstadt. No suggestion is given in Shankar that the disclosed conditions to form the diffusion layer could be used on substrates distinct from those of Shankar. Without a suggestion to combine the cited references of Shankar, Conner, and Duderstadt, this rejection must be withdrawn with respect to claims 93 and 94 since the rejection is improper as to independent claim 89 from which they depend.

In addition, as also previously discussed, although Duderstadt discloses a thermal barrier coating system on a nickel-based superalloy, there is no suggestion in either Duderstadt or Shankar to modify Shankar not only with respect to the ceramic layer but also the substrate. In the absence of a suggestion to modify Conner with the conditions set forth in Shankar followed by the thermal barrier layer of Duderstadt, a *prima facie* case of obviousness has not been established in the Office Action. This obviousness rejection must be withdrawn, particularly in light of the distinct substrate used by Shankar as compared to the Applicant's claimed invention,

and the lack of a suggestion in the prior art of the use of aluminum activity required by Applicant's claims.

H. Claims 12 and 13 over Conner in view of Shankar and further in view of Wukusick

Claims 12 and 13 have been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Conner in view of Shankar and further in view of Wukusick because, "[u]se of the claimed substrates would have been obvious in view of Wukusick for the reasons set forth above."

Office Action, page 7.

For the same reasons given by Applicant above, this § 103 obviousness combination rejection is improper because the prior art lacks a suggestion to combine the teachings of the cited references. Claims 12 and 13 depend from claim 8, which claims a method of preparing an article having a platinum-aluminide surface region on a nickel-base superalloy. There is no suggestion to combine the teachings of Shankar and Wukusick to substitute the nickel, cobalt, and iron substrate of Shankar with the nickel-base superalloy of Wukusick. The allegation that a certain alloy may be suitable for use as a turbine substrate does not force the conclusion that a specific diffusion layer, such as that of Applicant's claims, would be suitable for that substrate, or could be formed under the same conditions. Absent a suggestion to do so, there is no proper basis for a § 103 combination rejection.

Further, there is no suggestion to combine the conditions disclosed in Shankar with the substrate disclosed in Conner. Although Conner discloses the coating of a nickel-base superalloy with a platinum aluminide diffusion layer, Conner does not provide conditions for forming his platinum aluminide coating. Shankar discloses a method of and conditions for forming a protective diffusion layer on nickel, cobalt and iron base alloys, as contrasted to the nickel

superalloys of the invention which do not contain iron as set forth from page 5, line 20 to page 6, line 10, but does not disclose or suggest that the disclosed method and conditions can be used to form a similar protective diffusion layer on other substrates.

No basis is given in the rejection for the combination of the conditions cited in Shankar on the substrates cited in Conner or Wukusick. No suggestion is given in Shankar that the disclosed conditions to form the diffusion layer could be used on any other substrates, much less those of Conner.

Applicant reiterates that a proper § 103 obviousness combination rejection requires more than just a finding in the references the elements recited in the claim. To reach a proper teaching of Applicant's claimed process through a combination of references, there must be identified in the references themselves an objective motivation to combine the teachings of references, not a hindsight realization in light of the disclosure of the specification being examined. There is no teaching in Wukusick for forming a protective diffusion layer on his disclosed substrates, much less that the diffusion layers disclosed in Shankar would be acceptable on these very different base alloys or that the conditions given in Shankar could be used in conjunction with the deposition of coatings on the substrates of Conner or Wukusick.

In the absence of a suggestion to modify the conditions given in Shankar with the nickel base superalloy of Wukusick or Conner, a *prima facie* case of obviousness has not been established in the Office Action . For at least these reasons, this obviousness rejection must be withdrawn.

VII. CONCLUSION

Applicant submits that the application is in condition for allowance and respectfully requests a notice of allowance for all the pending claims. Should the Examiner determine that any further action is necessary to place this application in condition for allowance, the Examiner is kindly requested and encouraged to telephone Applicant's undersigned representative at the number listed below.

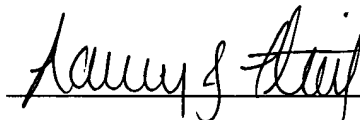
A check for \$920.00 made out to the Director of the United States Patent and Trademark Office is enclosed along with a request herein for a three month extension of time to file this response. It is believed that no further fees are due. However, if further fees are determined to be due, Applicant authorizes any such fees to be deducted from Deposit Account No. 50-0206.

Respectfully submitted,

HUNTON & WILLIAMS
1111 Brickell Avenue, Suite 2500
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(305) 810-2522

Date: April 3, 2002

By:

A handwritten signature in dark ink, appearing to read "Nancy J. Flint", is written over a horizontal line.

Nancy J. Flint
Reg. No. 46,704

APPENDIX

Marked Version of Amended Claims

8. (Amended) A method for preparing an article having a platinum-aluminide surface region, comprising the steps of:
- providing a substrate having a nickel-base [alloy] superalloy substrate bulk composition and a substrate surface;
 - depositing a layer of platinum upon the substrate surface;
 - diffusing a platinum from the layer of platinum into the substrate surface;
 - providing a source of aluminum; and
 - diffusing aluminum from the source of aluminum into the substrate surface for a time sufficient to produce a surface region at the substrate surface, the surface region having an integrated aluminum content of from about 18 to about [24] 28 percent by weight and an integrated platinum content of from about 18 to about 45 percent by weight, balance components of the substrate bulk composition.
12. (Amended) The method of claim 8, wherein the step of providing a substrate includes the step of
- providing a nickel-base [alloy] superalloy substrate which is substantially a single crystal and has a composition that includes from about 5 to about 16 weight percent aluminum and from about 1 to about 8 weight percent rhenium.

13. (Amended) The method of claim 8, wherein the step of providing a substrate includes the step of

providing a nickel-base [alloy] superalloy substrate which [is substantially a single crystal and] has a composition selected from the group consisting of (a) 7.5 percent cobalt, 7 percent chromium, 6.2 percent aluminum, 6.5 percent tantalum, 5 percent tungsten, 1.5 percent molybdenum, 3 percent rhenium, balance nickel; (b) 12.5 percent cobalt, 4.5 percent chromium, 6 percent aluminum, 7.5 percent tantalum, 5.8 percent tungsten, 1.1 percent molybdenum, 5.4 percent rhenium, 0.15 percent hafnium, balance nickel; and (c) 12 percent cobalt, 6.8 percent chromium, 6.2 percent aluminum, 6.4 percent tantalum, 4.9 percent tungsten, 1.5 percent molybdenum, 2.8 percent rhenium, 1.5 percent hafnium, balance nickel.

16. (Amended) A method for preparing an article having a platinum-aluminide surface region, comprising the steps of:

providing a substrate having a nickel-base [alloy] superalloy substrate bulk composition and a substrate surface;

depositing a layer of platinum [about 0.0003 inches thick upon the substrate surface];

heating the substrate and layer of platinum to a temperature of about 1800-2000°F for a time of about 2 hours;

providing a source of aluminum in contact with the substrate surface, the source of aluminum having an activity of about 40 to about 50 atomic percent as measured in a pure nickel foil; and simultaneously

heating the substrate surface and the source of aluminum to a temperature of about 1925-2050°F for a time of from about 4 to about 16 hours.

18. (Amended) The method of claim 16, wherein the step of providing a substrate includes the step of

providing a nickel-base [alloy] superalloy substrate which is substantially a single crystal and has a composition that includes from about 5 to about 16 weight percent aluminum and from about 1 to about 8 weight percent rhenium.

47. (Amended) [The method of claim 29] A method of forming a thermal barrier coating on a substrate, comprising:

chemical vapor depositing a diffusion aluminide layer on the substrate which includes a nickel base superalloy substrate under deposition conditions effective to provide an outer aluminide layer region comprising a solid solution intermediate phase and an inner diffusion zone region proximate the substrate;

said intermediate phase including an average aluminum concentration in the range of about 18 to about 28 % by weight, an average platinum concentration in the range of about 8 to about 45 % by weight, and an average nickel concentration of about 50 to about 60 % by weight so as to be non-stoichiometric relative to intermetallic compounds of aluminum and nickel, or aluminum and platinum, said outer aluminide layer region being substantially free of phase constituents other than said intermediate phase;

oxidizing the aluminide layer under temperature and oxygen partial pressure conditions effective to form an alpha alumina layer;

depositing a ceramic thermal barrier layer on the alumina layer; and

wherein said intermediate phase comprises a surface, distant from said inner diffusion zone region, and the intermediate phase includes the aluminum content and the platinum content which is relatively high adjacent to the surface and decreases with increasing depth into the intermediate phase.

73. (Amended) [The method of claim 56] A method of forming a thermal barrier coating on a substrate, comprising:

chemical vapor depositing a diffusion aluminide layer on the substrate which includes a nickel base superalloy substrate;

said aluminide layer including an average aluminum concentration in the range of about 18 to about 28 % by weight and an average platinum concentration in the range of about 8 to about 45 % by weight, wherein said diffusion aluminide layer further comprises a surface, and includes the aluminum content and the platinum content which is relatively high adjacent to the surface and decreases with increasing depth into the [diffusion] aluminide layer and the substrate[.]; and
depositing a ceramic thermal barrier layer on the aluminide layer.